

1969 at the Northeastern Station

NORTHEASTERN FOREST EXPERIMENT STATION
FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE
RICHARD D. LANE, DIRECTOR

1970

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**Northeastern Forest Experiment Station
Forest Service-U.S. Dept. of Agriculture**

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1969: GENERAL

AS THE NEW decade begins, we look back on 1969 and consider our activities, the changes that have taken place, the progress we have made, and our plans for the future.

As most years do, 1969 brought some changes in personnel. Ralph A. Klawitter joined us as our new assistant director in charge of forest insect and disease research, succeeding Dr. Carl E. Seliskar, who is returning to full-time research at our laboratory at Delaware, Ohio. Dr. Klawitter, who received his master and doctor of forestry degrees from Duke University, was previously principal silviculturist and project leader at the Southeastern Station, Asheville, N.C. In our support services staff, Norman L. Tuttle has succeeded John W. Moser as budget and fiscal officer.

Last year we lost three men through untimely deaths, two of our veteran research men and one of our administrative assistants.

- Arthur C. Hart, head of our research unit at Orono, Maine, conducting research on the culture of northern conifers, died on 16 September. Art, who had served with the Forest Service 28 years, had spent most of his professional career in studies of the spruce-fir forest type in Maine and New Hampshire.
- Richard H. Fenton, research forester, died on 25 March after being stricken with acute leukemia. Dick, who joined the Station after service as a Naval officer in World War II, served the Station in several positions: in forest economics, forest utilization, and timber management. His latest assignment was

in logging economics at our Forest Products Marketing Laboratory at Princeton, W. Va.

- John B. Miller, II, administrative assistant at our Forestry Sciences Laboratory at Morgantown, W. Va., died on 26 February at the University of Minnesota Medical Center. John, a graduate of Concord College in West Virginia, had served at our Laboratory in Princeton before transferring to the Morgantown Laboratory.

Our management analysis section has made steady progress in adapting automatic data processing to increase efficiency in many of our operations. Our analysts devised a system for storing and retrieving personnel data. For example, through our present computer setup we can retrieve—in a matter of seconds—information that under our old system might have taken a couple of man-days for clerks to dig out of the files. Our analysts also devised a system for recording information about manuscripts in process of editing and publication. Under our new system, the status of a manuscript can be checked out in seconds, and our monthly report on status of manuscripts can be produced in a few minutes. This has helped us spot causes of delay in our publications processes, as well as to reduce the time required by our staff to prepare the status report.

In disseminating research results, we have made steady progress. Our publications branch has reduced the time lag in getting research results published. A list of our publications—220 of them—in 1969 appears at the end of this report. If you want any of these reports, please write us and ask for them: for most of them we can provide either the reports or reprints.

Meanwhile our information branch has had some outstanding successes in publicizing our research results through the mass media. Our brochure on "Buying your Christmas tree" proved to be a best-seller: more than 80,000 copies have been distributed; and a number of newspapers, popular magazines, and radio and TV stations have given it publicity. Our research activities have been publicized in a series of weekly radio programs from New York titled "People, Cities, and Trees"; and several of our research men have taken part in these programs.

RESEARCH ACCOMPLISHMENTS

Some of the highlights of our research activities and accomplishments follow.

Symposiums

We jointly sponsored two symposiums this year on subjects of major interest to foresters and conservationists.

A 2-week international symposium on disturbed land—such as land strip-mined for coal—was held at The Pennsylvania State University in August. About 80 scientists from 14 states and 11 foreign countries met to discuss the chemical, physical, and biological environment of disturbed land as well as ways to improve these areas for productive use. The symposium was co-sponsored by the University's School of Forest Resources.

Nearly 200 foresters attended a 3-day symposium on paper birch and yellow birch at the University of New Hampshire in August. Twenty-nine papers were presented on the silviculture, management, and utilization of the birches. The symposium was planned and conducted by the University's Department of Forest Resources in cooperation with the Northeastern Station.

Our future plans include a symposium on environmental forestry, to be held in August 1970 at the University of Massachusetts, and a symposium on the upland oaks, which is scheduled for the summer of 1971 at the University of West Virginia. We hope that many of you will join us for these two events.

Silvicultural Guides for Paper Birch and Northern Hardwood Types

Silvicultural and ecological research in the major forest types continued to receive emphasis throughout the Station's territory. A direct result was the development of two detailed silvicultural guides—one for paper birch and the other for northern hardwoods. Both of these guides include prescriptions for treatments covering a wide range of stand conditions typical in the North-

east. The stocking guides specify desirable stand densities for stands of various mean diameters and number of trees per acre, with the goal of maintaining the maximum diameter growth of individual trees. For paper birch, recommendations are also given for cultural measures designed to enhance the aesthetic qualities of the environment.

In addition to the northern hardwood silvicultural guide mentioned above, the results of a precommercial thinning in northern hardwoods have been made available. Three methods of thinning—heavy and light crop-tree thinning, and species thinning—were carried out in a 25-year-old stand. Over a 5-year period, the heavy crop-tree thinning gave the best response, although all three thinnings stimulated bole growth with no apparent ill-effects on tree quality. Growth figures reported should be useful in management planning to determine the feasibility of intermediate cuttings.

The Economics of Silviculture

When either a single tree or an even-aged stand reaches the point where its value increase no longer earns the timber grower a satisfactory rate of return, it is said to be financially mature. Though financial maturity as a guide to timber harvesting must be tempered by biological considerations and the objectives of the grower, knowledge of it is useful for the best management decisions. Until recently, information about the financial maturity of hardwoods has been scarce. We have partially filled this gap by publishing financial maturity guides for yellow birch, northern red oak, white oak, and chestnut oak, using data from New Hampshire and West Virginia. In preparing these guides we considered the present value of a tree, the prospective value as judged both by growth rate and the potential to increase in quality, the time lapse necessary to reach this prospective value, and the rate of interest earned.

A New Way to Protect White Pine Seeds

Our studies of direct-seeding of white pine in New England show that much less endrin (a hard pesticide used to coat the

seed) is needed to protect seeds if they are buried than if they are sown on the soil surface. At endrin concentrations as high as 4 percent, more than half of the coated seeds that were sown on the soil surface were destroyed, mainly by small mammals. But, even with the lowest concentrations of endrin (0.5 percent), losses were only 3 percent when the seeds were covered with 1/3 to 1/4 inch of soil. These findings, and the recent development (by our researchers and the Maine Forest Service) of a mechanized seeder that makes direct-seeding of pine efficient and practical, will greatly reduce the need for endrin to protect white pine seeds.

New Approaches to Control of the Elm Bark Beetle

For several years scientists have suggested that the smaller European elm bark beetle feeds specifically on elm twigs because elm twig bark contains certain chemicals. In cooperation with two chemists at the Ohio State University Department of Pharmacy, we isolated and identified from the extract of American elm twig bark two compounds that stimulate feeding by adult elm bark beetles. In the laboratory, beetles were stimulated to feed on an inert substrate treated with either of these pure chemicals. Combination of the two pure chemicals stimulates beetle feeding that approaches 60-70 percent of feeding on the initial crude extract of elm bark.

This information may open up new approaches to the control of this insect and the disease it transmits. For example, tree geneticists may now be able to measure the susceptibility of new elm varieties to beetle feeding, based on the concentration of these chemicals in twig bark. Another possibility: we may be able to mask the stimulatory effects of these chemicals through chemical treatment of tree bark.

In other research on elm bark beetles, methoxychlor has shown promise as a control measure. Methoxychlor was selected because it is not so persistent in the environment as DDT and is less toxic to birds, animals, and people than DDT is. Research is still under way with a number of cooperators to answer several critical questions about this chemical's effectiveness and persistence before it can be recommended for field use.

Beetle Spreads Oak Wilt

We have shown that oak bark beetles meet the requirements for a vector for the oak wilt fungus in Missouri, Ohio, Pennsylvania, and West Virginia. They make breeding attacks on nearly all wilt-infected trees, often in large numbers. Many parent adults and their progeny—some contaminated with propagules of the fungus—leave the diseased tree to feed on healthy oaks, making wounds that are ideal infection courts for the fungus. Infection occurs when contaminated beetles feed on healthy oaks. Through control of the beetle population we may be able to drastically reduce the losses caused by this disease.

In other research on oak wilt, we have found that the fungus in *logs* can be killed by heat. The heat can be applied in a hot-water dip or by hot air. Fumigation with methyl bromide also gives complete control. These discoveries may open up again overseas markets for oak logs, which have been closed by other countries to prevent introduction of the oak wilt fungus into their oak forests.

Chemical Shows Promise for Spruce Budworm Control

Our participation in tests of Zectran in Idaho this summer indicates that this insecticide may be a suitable alternative to DDT for spruce budworm control. Zectran persists in the environment for only a short time, is toxic to spruce budworm, and has little effect on other organisms. Nearly 13 million acres of valuable commercial forest land in Maine, northern New Hampshire, Vermont, and New York would benefit from the development of an effective and ecologically acceptable insecticide for spruce budworm control.

An Inside Look at Tree Quality

We have published a straightforward and practical photo guide for estimating the extent and severity of discoloration and decay in living northern hardwood trees. Based on the dissection of 3,000 trees, and 100,000 isolations made to identify organisms, this photo guide (100 color photographs) describes the

complex processes that lead to discoloration and decay, and illustrates the typical patterns of discoloration and decay caused by different organisms. The guide suggests how the interior quality of a tree can be estimated from external signs of damage, and recommends silvicultural methods for making the best use of present stands and meanwhile encouraging crops of high-quality trees for the future.

Municipal Watersheds

A recent questionnaire study of municipal watersheds in the Northeast showed that over 2 million acres of land are controlled and managed for municipal water supplies. Timber cutting or harvesting was allowed on 54 percent of this land. Of the managers who allowed cutting, 58 percent did so primarily to improve water yields, and 42 percent did so to increase income to the company. Some form of recreation was allowed on 59 percent of the municipal watersheds surveyed. The major problems mentioned by the managers were associated with water-quality control, water-yield improvement, and recreation.

Strip-Mining and Water Quality

The effects of strip-mining on the water resources of small mountain watersheds are being investigated in eastern Kentucky and southern West Virginia. Preliminary results from eastern Kentucky show that stream turbidity and peak flows from mined areas increase greatly during mining and remain above normal for 6 months or more after mining is completed. Chemical concentrations, especially of sulfates and magnesium, have increased significantly in streams from mined areas, although there is an apparent lag in the buildup of the sulfates because time is essential to chemical weathering. Other chemicals have shown some buildup, too, although it is still too early to report on them.

Deer Hunters and Game Laws

In a recent mail survey of hunters in New York State, several differences and similarities were found between respondents known to be deer-law violators and respondents known *not* to

be violators. Results showed that violators legally kill more deer than nonviolators; that violators think they contact law-enforcement officers more often than nonviolators; and that violators, in certain parts of the State, feel justified in breaking game laws either for accidental reasons or for food—but not for psychological benefits. Both groups expressed dissatisfaction with hunting regulations that affect hunter distribution and behavior patterns, but neither group disagreed with laws that regulate numbers of deer.

Skidder Tires

Many logging contractors who have been using wheeled skidders in the Appalachians have been plagued with problems of excessive tire wear. Some contractors get 3 years of service from tires, but others get only 6 months of tire service. Because of these differences, we made a study to determine the causes of tire wear. The most significant factor was the size of rocks in the skidroads. On roads with large rocks, tire wear was almost three times that on roads with small rocks. By relating tire wear to eight measured factors, we developed prediction equations that a logger can use to predict tire wear for a particular logging job.

Up-To-Date Forest-Survey Reports for Ohio and New York

We have recently completed resurveys of the timber resources of Ohio and New York, and reports on these surveys are being prepared for publication. The new surveys showed that forest-land areas and timber volumes increased in both States since the last survey. The increase in forest land area is due primarily to abandonment of marginal farm land. The increases in growing stock and sawtimber volume are attributed to both the increase in forest area and an excess of growth over removals for the period between inventories. The forest survey was intensified in both States by taking additional field plots. Funds for the intensification were contributed by the States.

The SHOLO Process for Low-Grade Hardwood Logs

A new mill process, called SHOLO (from SHORt LOg), has been developed as one solution to the old problem of how to profitably convert low-grade hardwood logs into useful products. From long factory-grade 3 or poorer logs, the SHOLO process produces high-quality pallet parts and pulp chips. A conservative analysis shows that an annual rate of return of 15 percent after taxes can be expected. The process seems ideal for paper companies, pulp chip producers, and timber companies interested in reforestation. The process is simple and flexible, and does not require highly skilled labor.

Structural-Grade Plywood from Low-Grade Sawlogs

Although the production of lumber from low-grade sawlogs is generally not profitable enough to be attractive to industry, hardwood forests in the central Appalachians contain a large supply of low-grade sawtimber that may be suitable for structural-grade plywood. In a pilot study of plywood production we found that: (1) grade-3 oak logs can be converted into plywood with existing softwood manufacturing equipment and methods; (2) the plywood yield and production rates resulted in a competitively priced product; and (3) the hardwood plywood produced has desirable characteristics for a number of structural uses. The plywood produced in this study is now being tested as decking for commercial warehouse pallets, sheathing, subflooring, and other structural uses. Other hardwood species and species mixes will be considered in future research.

A New Grading System for White Pine Logs

As the culmination of 10 years of timber-grade research, we have developed white pine log- and tree-grading systems that are applicable throughout the commercial range of the species. The log-grading system has been approved as a standard Forest Service system, and the tree-grading system has been given interim status

pending further testing. The systems are expected to meet the needs of both forest managers and forest industry.



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1969 PUBLICATIONS

by staff members and cooperators
of the Northeastern Forest Experiment Station

GENERAL

Cliff, Edward P.

1969. **Our birch resources.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 1-5. Upper Darby, Pa.
A general survey of the birch resources and the need for northern hardwood land to supply various and conflicting demands. Points out that research is needed to find better and faster ways of growing the timber needed, and places special emphasis on producing high-quality birch.

Larson, Edwin vH.

1969. **A girl-watcher looks at the birches.** USDA Forest Serv. NE. Forest Exp. Sta., 4 pp. Upper Darby, Pa.
A brochure prepared for the Birch Symposium, in which the birches are eulogized as the pretty girls of the forest.

McQuilkin, William E.

1969. **Thirty years of Federal forest research in the Anthracite Region.** Pa. Forests 59(2): 58-62, illus.
A review of the 30 years of Federal forest research in Pennsylvania's anthracite coal region and adjoining Pocono Plateau area. The impact of early forest surveys and forest management, watershed management, and mine-spoil revegetation research is discussed; and accomplishments are summarized.

Northeastern Forest Experiment Station.

1969. **Report 1968.** USDA Forest Serv. NE. Forest Exp. Sta., 42 pp., illus. Upper Darby, Pa.
A report on the Station's activities and accomplishments in 1968, plus an annotated list of publications during the year.

Northeastern Forest Experiment Station.

1969. **Bartlett Experimental Forest.** USDA Forest Serv. NE. Forest Exp. Sta., 12 pp., illus. Upper Darby, Pa.
A brochure describing the research activities at the Bartlett Experimental Forest, Bartlett, N. H. The Forest is a field lab-

oratory of the Experiment Station's Durham, N. H., Forest Sciences Laboratory project on the growth, culture, and composition of northern hardwoods.

Northeastern Forest Experiment Station.

1969. **Fernow Experimental Forest.** USDA Forest Serv. NE. Forest Exp. Sta., 12 pp., illus. Upper Darby, Pa.

A fold-out brochure describing the research activities of the Fernow Experimental Forest, Parsons, W. Va. The Forest is the field laboratory of the Experiment Station's Parsons, W. Va., Timber and Watershed Laboratory for studies in managing mountainous forest land.

Northeastern Forest Experiment Station.

1969. **Buying your Christmas tree.** USDA Forest Serv. NE. Forest Exp. Sta., 24 pp., illus. Upper Darby, Pa.

A brochure designed to help consumers shop for and care for Christmas trees. Contains descriptions of 15 species used as Christmas trees.

Northeastern Forest Experiment Station.

1969. **People, cities, and trees.** USDA Forest Serv. NE. Forest Exp. Sta., 16 pp., illus. Upper Darby, Pa.

A brochure that tells how trees help improve big-city environment, and how forest products and research serve the public. The Northeastern Station conducts research on how to control insects and diseases in trees; on how to increase the recreational value of forests; and on how to use trees to help solve pollution, water, housing, and health problems.

Northeastern Forest Experiment Station.

1969. **Black diamonds and green vistas.** USDA Forest Serv. NE. Forest Exp. Sta., 14 pp., illus. Upper Darby, Pa.

A brochure describing research the USDA Forest Service is conducting on the reclamation of coal mine spoils, including physical problems, spoil chemistry, choosing cover plants, and improving water conditions.

Northeastern Forest Experiment Station.

1969. **Medicinal plants research.** USDA Forest Serv. NE. Forest Exp. Sta., 12 pp., illus. Upper Darby, Pa.

A brochure describing research by the Forest Service in the problem of growing forest plants that are of medicinal value. Medicinal plants are indispensable to medicine and are vital to the ice cream, textile, and toiletry industries.

Rammrath, Rita M.

1969. **Curbing insects to save tomorrow's trees.** Ohio Woodlands 7(3): 2-3, illus.

The USDA Forest Service Forest Insect and Disease Laboratory at Delaware, Ohio, conducts applied and basic research

on forest disease and insect problems in the Northeastern region. Methods of biological control, air-pollution damage, oak borers, and virus and fungus disease are being studied. A \$950,000 expansion of the Laboratory is under construction.

Rammrath, Rita M.

1969. **Tulip tree scale.** Ohio Woodlands 7(3): 11.

Researchers at the USDA Forest Service Forest Insect and Disease Laboratory at Delaware, Ohio, are investigating the tulip tree scale insect, which attacks yellow-poplar. A planting pattern has been devised, with alternate rows of red pine and yellow-poplar, that reduces wind dissemination of the insect within yellow-poplar stands.

USDA Forest Service.

1969. **Forests for the future.** USDA Forest Serv. Eastern Region and NE. Forest Exp. Sta., 10 pp., illus.

A brochure that highlights the advantages of clearcutting and explains its use in forest management, based on the results of clearcutting and even-aged management research by the Forest Service.

TIMBER MANAGEMENT

Bjorkbom, John C.

1969. **Seeding and planting birch.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 79-82. Upper Darby, Pa.

A summary of the current state of knowledge about artificial regeneration of hardwoods, especially birch, in the Northeast. Seeding and planting on old fields and areas recently cut are discussed.

Blum, Barton M.

1967. **A taphole marking device.** Natl. Maple Syrup Dig. 6(3): 8-9, illus.

Preliminary results indicate that a short strand of weather-resistant material attached to a wooden dowel works well as a taphole marker for sugar maple trees. The marker permits drilling adjacent to old tapholes without fear of hitting discolored wood and has been found to have no noticeable effect on taphole healing.

Burton, D. H., H. W. Anderson, and L. F. Riley.
1969. **Natural regeneration of yellow birch in Canada.**
USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp.
Proc.: 55-73, illus. Upper Darby, Pa.

There seems to be little problem in getting yellow birch to regenerate, but information is needed on helping this regeneration grow into veneer-quality trees. The research on this problem that is being done in Canada is described.

Carl, Clayton M., and Harry W. Yawney.
1969. **The use of pentane to separate filled and empty sugar maple samaras.** Tree Planters' Notes 20(3): 24-27, illus.
Pentane is between 95 and 100 percent effective for separating filled and empty sugar maple samaras when their moisture content is in excess of 50 percent (dry-weight basis). Although soaking in pentane for periods as long as 1 hour does not adversely affect viability, it does delay germination by as much as 2 weeks.

Clausen, Knud E., and Peter W. Garrett.
1969. **Progress in birch genetics and tree improvement.**
USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp.
Proc: 86-94, illus. Upper Darby, Pa.
Several studies of variation have been made or are in progress, some crossability studies have been made, and some hybrids are being tested. Though much basic work remains to be done, information acquired so far justifies practical improvement efforts with yellow birch and paper birch.

Doolittle, Warren T.
1969. **Productivity of forest land for tree growth.** (Abstr.)
Soc. Amer. Foresters 1968 Annu. Meeting Abstr.
Papers: 32.
An outline of the information needed to determine the productivity of forest land for tree growth.

Doolittle, Warren T.
1969. **Research in urban forestry.** J. Forestry 67: 650, 652, 656.
Trees in urban areas often grow under extremely adverse conditions of soil, water, and air. But many benefits are derived from these trees and forests. The objectives of research in urban forestry are to establish, maintain, and grow trees that will improve living in urban areas.

Doolittle, Warren T.
1969. **Research in urban forestry.** (Abstr.) Soc. Amer. Foresters 1968 Annu. Meeting Abstr. Papers: 10.
An outline of research needed to provide better ways to establish and maintain tree species under the adverse soil and atmospheric conditions often encountered in urban areas.

Filip, Stanley M.

1969. **Natural regeneration of birch in New England.** USDA Forest. Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 50-54, illus. Upper Darby, Pa.

A summary of what is known about the effects of various cutting methods and seedbed conditions on the natural regeneration of birch in New England. Practical application of this knowledge is discussed.

Filip, Stanley M.

1969. **Panel comments.** USDA Forest Serv. NC. Forest Exp. Sta. Sugar Maple Conf. Proc.: 94. St. Paul, Minn.

Comments on papers by Carl H. Tubbs and Richard M. Godman given at the Sugar Maple Conference.

Gabriel, William J.

1969. **Mass testing for sap sugar concentration in sugar maple seedlings.** NE. Forest Tree Impr. Conf. Proc. 16: 25-26.

A discussion of micro-tapping techniques used to obtain sap from 2- to 3-year-old seedlings for testing sap sugar content. Best results were obtained by drilling a lead hole in the sapling and inserting a No. 20 hypodermic needle to extract the sap.

Gabriel, William J.

1969. **The search for sweet sugar maples.** Nat. Maple Syrup Dig. 8(1): 8.

A report after 5 years of a program to select and breed sugar maples with sweeter sap. Sweeter trees have been selected and will be cross-bred. Eventually seed from the best trees will be used to establish new sugarbushes.

Garrett, Peter W.

1969. **Height growth and foliage color in a Scotch pine provenance study in northern Michigan.** USDA Forest Serv. Res. Note NE-96, 7 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A Scotch pine provenance study conducted in northern Michigan revealed important differences in height growth and foliage color among seedlings from 83 European sources. Seed from southern European sources produced seedlings with the best fall foliage coloration. Height growth was fastest among seedlings from sources with latitudes like that of the Michigan planting site.

Gibbs, Carter B.

1969. **The effect of xylem age on volume yield & sugar content of sugar maple sap.** USDA Forest Serv. Res. Paper NE-141, 11 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A study to determine the relationship of the average age of

sugar maple xylem to sap volume yield and sap-sugar content showed that largest sap volumes were obtained from xylem with a mean age of about 35 years. Sap-sugar content was highest near the outside of the tree and decreased with increasing depth and mean xylem age.

Gibbs, Carter B.

1969. **Improving your sugarbush? Use fall sap sugar percentages.** Nat. Maple Syrup Dig. 8(1): 18.

A comparison of fall and spring sap sweetness showed that trees high in sugar content in the fall have high sugar content in the spring too, so fall sugar percentages may be used to locate high-sugar trees.

Gibbs, Carter B.

1969. **Highlights of Forest Service tubing research.** Nat. Maple Syrup Dig. 8(3): 31-32.

A review of USDA Forest Service research on the use of tubing in collecting sugar maple sap. In the last four seasons, work has been completed on vented and unvented aerial and groundline installations and on the use of artificial vacuum.

Gibbs, Carter B., and Albert G. Snow.

1969. **Use for sap production.** USDA Forest Serv. NC. Forest Exp. Sta. Sugar Maple Conf. Proc. 88-93. St. Paul, Minn.

A discussion of improvements in sugar maple sap-production methods, characteristics of trees suited for sap production, and various aspects of sugarbush management. It is concluded that for efficient use of the sugar maple resource we need more information about tree characteristics, silvicultural practices, and the economics of sap and timber production.

Gingrich, Samuel F.

1969. **The effects of density, thinning, and species composition on the growth and yield of the oak and yellow-poplar types.** (Abstr.) Soc. Amer. Foresters 1968 Annu. Meeting Abstr. Papers: 23-24.

A discussion of the effects of density on hardwood stands indicates that the naturally high density of these stands results in trees of low vigor and that overstocking may be more damaging to growth rates than understocking.

Godman, Richard M., and David A. Marquis.

1969. **Thinning and pruning in young birch stands.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 119-127. Upper Darby, Pa.

A discussion of thinning and pruning practices in young paper and yellow birch stands. Cleaning and weeding, methods of release, intensity of release, time requirements, growth response, tree quality, and liberation cuttings are described.

The effects of thinning on stem quality and stocking as well as methods of pruning are discussed.

Goodhue, Sargent.

1969. **Birch management on New Hampshire state lands.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 169-171. Upper Darby, Pa.

Notes on management practices used for paper birch and yellow birch. It is expected that the practices now in use will maintain the present proportions of these species.

Grabner, Raymond E.

1969. **Seed losses to small mammals after fall sowing of pine seed.** USDA Forest Serv. Res. Paper NE-135, 16 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Four concentrations of endrin were used in chemical coatings to protect white pine and red pine seeds from predation by birds and rodents. Major seed losses occurred, due primarily to small mammals, especially mice. Seed placement was the key: only 3 per cent of the buried seeds were lost, while more than half of the seeds exposed on the soil surface were lost.

Grabner, Raymond E., and Donald F. Thompson.

1969. **A furrow-seeder for the Northeast.** USDA Forest Serv. Res. Paper NE-150, 14 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A furrow-seeder designed for planting on rough, stony land was evaluated on a wide range of wildland conditions in northern New England. The unit performed satisfactorily at the nine locations where it was tested. Production rates for sowing and covering seeds varied widely depending on land conditions. Estimated cost of direct seeding with this equipment ranged from \$7 to \$15 per acre.

Hanks, Sidney.

1969. **Birch nursery practice.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 83-85. Upper Darby, Pa.

Relatively little birch is grown for reforestation. Seed collection, extraction, cleaning, and storage are described, as well as seedbed preparation and sowing methods. Protection against deer is needed.

Howe, George E.

1969. **Early results of a sugar maple provenance study.** NE. Forest Tree Impr. Conf. Proc. 16: 27.

A discussion of the nursery performance of 2-year-old seedlings in a provenance study of 30 sugar maple sources from Oklahoma to New Brunswick. Preliminary results of this long-term study suggest that such factors as variation in time of seed germination, variation in planting technique, and plant-

ing shock partially mask the genetic expression of growth differences in the seedlings.

Howe, George E.

1969. **A vibrator for collecting pollen.** Forest Sci. 15: 144, illus.

A vibrator patterned after a tomato pollen collector proved useful for collecting sugar maple pollen. It saved time and reduced the trash accumulation that occurs when pollen is collected in the ordinary manner. The construction of the vibrator is described, and its operation is explained.

Hoyle, M. C.

1969. **Response of yellow birch in acid subsoil to macronutrient additions.** Soil Sci. 108: 354-358.

Yellow birch seedlings were grown under artificial light in a podzol subsoil variously treated with P, N, and dolomitic limestone. Growth of control seedlings and those receiving only limestone was unsatisfactory; growth of seedlings that received P additions was considerably better. Further improvements were obtained when limestone and N were supplied along with P.

Hoyle, M. C.

1969. **Variation in content of microelements in yellow birch foliage due to season and soil drainage.** Soil Sci. Soc. Amer. Proc. 33: 458-459.

A study to determine the levels of foliar Al, Mn, Zn, Cu, and B in yellow birch trees growing on well-drained and poorly drained soils showed that concentrations usually decreased early in the growing season and then leveled off or increased. The total content of each microelement usually increased with time, though rates varied. Microelement uptake was comparable on both soils for Cu and B, but Al, Mn, and Zn uptake was significantly higher on poorly drained soil.

Hoyle, Merrill C., and John C. Bjorkbom.

1969. **Birch nutrition.** USDA Forest. Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 102-105, illus. Upper Darby, Pa.

Much of the slow growth and poor development of birches in New England can be traced to inadequate soil fertility or to toxic elements in the soil. The authors discuss the present state of knowledge in nutrition research—what can be done and what results can be expected with birch.

Kelso, Elmer G.

1969. **Birch management on the White Mountain National Forest.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 165-168. Upper Darby, Pa.

Several factors influence management and cutting practices: tolerance, multiple use, insects and diseases, and logging

methods. It has been found that on the White Mountain National Forest, hard cutting is necessary to increase the volume of birch and ash. The author points out that silvicultural clearcuttings are desirable and that scarification increases the amount of regeneration.

Kriebel, H. B., and W. J. Gabriel.

1969. **Genetics of sugar maple.** USDA Forest Serv. Res. Paper WO-7, 17 pp., illus.

A discussion of the genetics of sugar maple, pointing out that the species is complex and wide-ranging, with recognizable geographic patterns of morphological and physiological variation. Sap sugar content is inherited and varies widely among individual trees, but more information is needed on the physiology of rooting. Contains a discussion of floral biology and suggests breeding programs for several objectives.

Krochmal, Arnold.

1969. **Deer's tongue, *Trilisa odoratissima*, a useful plant of southeastern United States.** Econ. Bot. 23(2): 185-186, illus.

A brief description of this plant (used in cigarettes for flavoring), including notes on range, collection, curing, packaging, and marketing.

Krochmal, Arnold.

1969. **Low volume papaya processing in Surinam.** World Crops, March/April: 22-23, illus.

Through a series of photos, the processing of papaya is shown in an ideal small processing plant at an experiment station in Surinam. The system is suitable for other tropical fruits.

Krochmal, Arnold.

1969. **Propagation of cassava.** World Crops, July/August: 193-195, illus.

The most successful method of planting was found to be the flat method, in which the propagation sticks are planted horizontally below the soil surface. This method gave a higher germination rate, tuber development closer to the soil surface, and a greater number of tubers than the other methods.

Krochmal, Arnold, Russell S. Walters, and Richard M. Doughty.

1969. **A guide to medicinal plants of Appalachia.** USDA Forest Serv. Res. Paper NE-138, 291 pp., illus. NE Forest Exp. Sta., Upper Darby, Pa.

Illustrated descriptions of 126 medicinal plants of the Appalachian region, with information for collectors about where the plant grows, parts used, reputed and recognized usages, flowering period, and common names. Plant collecting and preparation methods are also described. Glossary of pharmaceutical and botanical terms is included.

Leak, W. B.

1969. **Stocking of northern hardwood regeneration based on exponential dropout rate.** *Forestry Chron.* 45: 344-347. Survival and mortality in even-aged seedling-sapling northern hardwoods are described as an exponential process. Regeneration stocking guides based on this mathematical process are presented.

Leak, William B.

1969. **Financial maturity of yellow birch.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 145-146. Upper Darby, Pa.

Methods used to compute financial maturity of yellow birch sawtimber and veneer-logs vary only in minor detail from those used for paper birch sawtimber. The results of this study on the rates of value increase of yellow birch have important applications to the silviculture and management of northern hardwood stands containing yellow birch.

Leak, William B., Stanley M. Filip, and Dale S. Solomon.

1969. **Rates of value increase for yellow birch in New England.** USDA Forest Serv. Res. Paper NE-120, 11 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Compound interest rates of value increase for yellow birch over a 10-year period were computed for a range in vigor class (growth rate), veneer-log and sawlog grades, merchantable height, and d.b.h. An improvement in log grade over the period resulted in moderate to high compound interest rates. Otherwise rates were low. Recommendations on tree marking and choice of optimum harvest size, based on grade-improvement potentials, are given.

Leak, William B., Dale S. Solomon, and Stanley M. Filip.

1969. **A silvicultural guide for northern hardwoods in the Northeast.** USDA Forest Serv. Res. Paper NE-143, 34 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A practical guide to the management of northern hardwoods for timber production in New England and New York. Both even-aged and uneven-aged management are considered, and specific treatments are prescribed for a range of stand conditions and management objectives.

Ledig, F. T., R. W. Wilson, J. W. Duffield, and G. Maxwell.

1969. **A discriminant analysis of introgression between *Quercus prinus* L. and *Quercus alba* L.** *Bull. Torrey Bot. Club* 96: 156-163.

A discriminant function based on leaf morphology was used to separate seedling rock chestnut oak, *Q. prinus*, and white oak, *Q. alba*. The values of the function were calculated for the progeny of a putative hybrid *Q. x saulii* growing in a

mixed stand of the parental species, and the frequency distribution was compared with that of the parents.

Little, S.

1969. **Local seed sources recommended for loblolly pine in Maryland and shortleaf pine in New Jersey and Pennsylvania.** USDA Forest Serv. Res. Paper NE-134, 16 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Data on survival, height, basal area, merchantable volume, defects, and winter injury from four plantations indicate that local seed sources should be used in establishing loblolly pine stands in Maryland and shortleaf pine stands in southern New Jersey or southeastern Pennsylvania. Local sources provide trees adapted to the local climates, and these trees usually grow much faster in the Northeast than stems that originate from seed collected farther south.

Marquis, David A.

1969. **Thinning in young northern hardwoods: 5-year results.** USDA Forest Serv. Res. Paper NE-139, 22 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A study was made of the effects of heavy and light crop-tree thinning and species thinning on a 25-year old northern hardwood stand. Results show that heavy crop-tree thinning was the most effective, but all three thinnings stimulated bole growth with no apparent decrease in tree quality. Tables of predicted diameter and basal area growth are presented.

Marquis, David A.

1969. **Silvical requirements for natural birch regeneration.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 40-49, illus. Upper Darby, Pa.

A discussion of research on the silvical requirements for natural birch regeneration and how the desired conditions for regeneration can be achieved through the choice of silvical techniques. Factors affecting birch regeneration, including seed supply and environmental conditions, can be combined for predicting the amount of regeneration in a given situation.

Marquis, David A., and Thomas W. Beers.

1969. **A further definition of some forest growth components.** J. Forestry 67: 493.

The forest growth components—accretion, survivor growth, and gross growth of initial volume—are defined to clarify their proper use and to encourage the use of precise terminology.

Marquis, David A., Dale S. Solomon, and John C. Bjorkbom.

1969. **A silvicultural guide for paper birch in the Northeast.** USDA Forest Serv. Res. Paper NE-130, 47 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A practical guide to the management of paper birch stands

for timber production, covering both the establishment of new stands and the culture of existing stands. Includes a set of prescriptions describing specific treatments to be applied for a range of stand conditions and management objectives. Also provides some information about management of paper birch stands for aesthetic and other purposes.

Norcott, Kendall S.

1969. **Birch management on industry lands.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 172-175. Upper Darby, Pa.

The Brown Company's experience in timber management leads to the conclusions that clearcutting will increase the changes of establishing fair stands of young hardwood, which in many places will contain reasonably high percentages of birch; and that it may be necessary to limit the area of the clearcuts to insure establishment of hardwood seedlings. The Company's operations today are geared to use of rubber-tired skidders and other mechanical equipment.

Northeastern Forest Experiment Station.

1969. **Birch symposium proceedings.** USDA Forest Serv. NE. Forest Exp. Sta., 183 pp., illus. Upper Darby, Pa.

A collection of 29 papers about the birches, presented at a symposium held in August 1969 at the University of New Hampshire, Durham, N. H. Individual papers are listed separately.

Post, Boyd W., Willard H. Carmean, and Robert O. Curtis.

1969. **Birch soil-site requirements.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 95-101, illus. Upper Darby, Pa.

The commercial range of the birches covers several regions having diverse topography, geology, soils, and climate. Additional soil-site studies are needed to adequately describe the complex site relations for hardwoods throughout this range; these studies include site comparisons among species and improved site-index curves based on stem-analysis methods.

Rushmore, Francis M.

1969. **Sapsucker damage varies with tree species and seasons.** USDA Forest Serv. Res. Paper NE-136, 19 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Yellow-bellied sapsuckers (*Sphyrapicus varius varius* L.) were observed feeding on 26 tree species and 2 shrub species in Maine and elsewhere in the Northeast on 205 days in April to October 1964-68. Species preferences varied with season. Both hardwoods and conifers received bird peck resulting in damage; some hardwoods were killed; conifers seldom were. The species fed on most were hemlock, red maple, and yellow,

paper, and gray birches. Timber management and other implications are discussed.

- Safford, Lawrence O., Robert M. Frank, and Elbert L. Little, Jr.
1969. **Trees and shrubs of the Penobscot Experimental Forest, Penobscot County, Maine.** USDA Forest Serv. Res. Paper NE-128, 27 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A brief description of the Penobscot Experimental Forest in southern Penobscot County, Maine, and an annotated list of 103 species of trees, shrubs, and woody vines growing naturally there. Also contains a list of research reports based on work done on the forest.

- Schreiner, Ernst J.
1968. **Sélection des essences forestières.** FAO Unasylya 22(3): 3-9.

French version of "Forest tree breeding" (Unasylya 22[3]: 3-9, 1968). Salient points on sampling, evaluation, and utilization of genetic resources of forest trees are presented in the light of recent biological research.

- Schreiner, Ernst J.
1968. **Mejoramiento genético de especies forestales.** FAO Unasylya 22(3): 3-9.
Spanish version of the above.

- Schreiner, Ernst J.
1969. **Tree breeding in the United States forestry practice.** FAO-IUFRO Second World Consult. on Forest Tree Breeding. Sect. IV, 22 pp.

This report highlights the expansion and achievements of tree breeding in the United States forestry practice and research since 1936. It is also available in French and Spanish versions.

- Smith, H. Clay
1969. **Bark thickness related to tree diameter in sugar maple** (*Acer saccharum* Marsh.). USDA Forest Serv. Res. Note NE-107, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Bark thickness of sugar maple trees in Vermont was found to be related to tree diameter at breast height (d.b.h.). The relationship was positive: as the diameter increased, the bark thickness increased.

- Smith, H. Clay
1969. **Use either aerial line or ground line tubing with vented spouts.** Nat. Maple Syrup Dig. 8(2): 6-7, illus.
If vented spouts are used when collecting maple sap, it makes little difference whether aerial- or ground-line tubing is used.

Other factors—such as distances between trees, ground conditions, costs of installation, maintenance, and dismantling—should be considered.

Snow, Albert G., Jr.

1969. **Our sugar maple resource.** Nat. Maple Syrup Dig. 8(1): 20-22, illus.

A summary of topics covered at the Sugar Maple Conference in Houghton, Mich.: the sugar maple resource, species improvement, insects and diseases, sugarbush management, and artificial regeneration.

Snow, Albert G., Jr., and Carter B. Gibbs.

1969. **Milking sugar maple trees for more sap.** S. Lumberman 219 (2728): 161-162, illus.

This discussion of the modernization of the maple sugar industry focuses on the use of vacuum pumps and plastic tubing to increase sap yields and profits and to reduce labor and costs.

Solomon, Dale S., and William B. Leak.

1969. **Stocking, growth, and yield of birch stands.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 106-118, illus. Upper Darby, Pa.

A summary of available information about site estimation, stocking, short-term growth, and yield of birch stands. The data apply to even-aged stands of paper birch, and to both even-aged and uneven-aged mixed northern hardwood stands containing at least 5 percent yellow birch.

Trimble, George R., Jr.

1969. **More intensive forest management ahead in Northeast and Appalachians.** Pulpwood Annu. 1969: 105-106.

Silviculturally intensive even-aged systems will be used to manage the Third Forest of the Northeast and the Appalachians for wood products. Intensive cultural practices will mean increased thinning, pruning, and artificial reforestation with genetically improved stock of both hardwoods and softwoods. Increased research will determine intensity, timing, and methodology for cultural operations. Management will closely relate species, site, and product objectives.

Trimble, George R., Jr.

1969. **Panel comments.** USDA Forest Serv. NC. Forest Exp. Sta. Sugar Maple Conf. Proc.: 28. St. Paul, Minn.

Comments on papers given at the Sugar Maple Conference by Howard B. Kriebel, Boyd W. Post, and James W. Marvin.

Trimble, George R., Jr.

1969. **Diameter growth of individual hardwood trees—the effect of certain tree and environmental factors on the**

growth of several species. USDA Forest Serv. Res. Paper NE-145, 25 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

A study was made of d.b.h. growth rates of individual hardwood trees in West Virginia, testing the effects of (1) tree crown and vigor classes, (2) crown parameters of diameter, length, crown ratio, and diameter by length, (3) initial tree d.b.h., (4) surrounding basal-area density, and (5) species and site quality. The results indicated that after the effect of species, site quality, and crown class were identified, none of the other variables tested added appreciable growth prediction information.

Trimble, George R., Jr., and E. H. Tryon.

1969. **Survival and growth of yellow-poplar seedlings depend on date of germination.** USDA Forest Serv. Res. Note NE-101, 6 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A study of yellow-poplar seedlings showed that early survival and growth were best among stems that originated in May and early June. Few, if any, seedlings that emerged after 1 July were in favorable competitive condition 3 years later. This indicates that clearcuttings made for maximum natural regeneration of yellow-poplar should be carried out in fall and winter to permit early germination in the spring.

Tubbs, Carl H.

1969. **Natural regeneration of yellow birch in the Lake States.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 74-78, illus. Upper Darby, Pa.

Yellow birch has been difficult to regenerate. Regardless of the cutting method or silvicultural system used, little regeneration follows unless advance regeneration is removed or the site is scarified.

Walters, Russell S., and O. M. Davenport.

1969. **Early spring straightening can save crooked trees.** Amer. Christmas Tree J. 13(1): 7-10, illus.

Basal crooks can develop on trees that were either planted in a leaning position by frost-heaving, snow, or wind. Loss of tree quality and value because of such crooks can be prevented by straightening young seedlings before growth starts each spring.

Yawney, Harry W.

1969. **Artificial regeneration.** USDA Forest Serv. NC. Forest Exp. Sta. Sugar Maple Conf. Proc.: 65-74, illus. St. Paul, Minn.

A summary of what is known about the artificial regeneration of sugar maple. Information is presented on seed, nursery practices, and field planting.

- Yawney, Harry W., and Clayton M. Carl, Jr.
1969. **An improved seedling root-volume measuring device.**
Tree Planters' Notes 20(3): 7-8, illus.
A modified version of a device for measuring root volumes of small seedlings is described.

FOREST ECONOMICS

- Barnard, Joseph E., and Teresa M. Bowers.
1969. **A glimpse at New York's current timber resource.**
USDA Forest Serv. Res. Note NE-95, 6 pp., illus.
NE. Forest Exp. Sta., Upper Darby, Pa.
Data from the recent forest survey of New York reveal a 13 percent increase in commercial forest land area, a 12 percent increase in the cubic-foot volume of growing stock, and a 4 percent decrease in the board-foot volume of growing stock in the 18-year period between surveys.

- Barnard, Joseph E., and Teresa M. Bowers.
1969. **A preview of Ohio's forest resource.** USDA Forest Serv. Res. Note NE-97, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
The recent forest survey reveals that there has been a 933,000-acre increase in commercial forest land, a 32 percent increase in the cubic-foot volume of growing stock, a 30 percent increase in the board-foot volume of sawtimber, and an excess of net growth over removal since the 1952 inventory.

- Bones, James T., and David R. Dickson.
1969. **Primary wood products output in Ohio—1966.** USDA Forest Serv. Resource Bull. NE-18, 18 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
The results of a 100 percent canvass of the primary wood manufacturers in Ohio. The report contains data about wood receipts by manufacturers and species groups, production by counties and species, and disposition of plant residues. Recent trends within the industry are noted.

- Bones, James T., and Neal P. Kingsley.
1969. **Pulpwood production in the Northeast—1968.** USDA Forest Serv. Resource Bull. NE-15, 30 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
An annual report based on canvasses of pulpwood production in the Northeast, containing data about pulpwood production from roundwood in the 14 Northeastern States by counties and species groups, and pulpwood chip production from plant

residues. Comparisons are made with the previous year's production data. Trends in pulpwood production for the past 6 years are shown.

Bones, James T., and Carl E. Mayer.

1969. **Primary wood products output in New York—1967.** USDA Forest Serv. Resource Bull. NE-17, 15 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The results of a 100 percent canvass of the primary wood processors of New York State. This report contains data about wood receipts by manufacturing groups and species groups, production by counties and species, and disposition of plant residues. Recent trends within the industry are noted.

DeBald, Paul S., and Roger E. McCay.

1969. **The timber resources of the Ohio Hill Country.** USDA Forest Serv. Resource Bull. NE-14, 73 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A report on the 1967 resurvey of the Hill Country, presenting statistical findings on forest area, timber volume, net annual growth, and timber removal; pointing out changes that have occurred since the initial forest survey of 1952; and describing recent trends in the timber resource, its current uses, and an outlook for the future. Contains 42 tables of statistical data, including forest areas and timber volumes for counties.

Gansner, David A., and David N. Larsen.

1969. **Pitfalls of using internal rate of return to rank investments in forestry.** USDA Forest Serv. Res. Note NE-106, 5 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Using the internal rate of return concept to rank the economic desirability of investment opportunities can lead to incorrect investment decisions. Present value provides a correct and unambiguous means of judging such investment alternatives.

Gansner, David A., and Edgar T. Shaudys.

1969. **Opportunities for pulpwood growing investment in southeastern Ohio.** USDA Forest Serv. Res. Paper NE-151, 24 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Evaluates opportunities for investing in a management system to produce hardwood pulpwood in southeastern Ohio and provides a means for answering questions important to investment decisions. Results indicate the most lucrative investment possibilities occur on forest land of site index 70 or better, when treatment costs are less than \$10 per acre and projected prices for stumpage exceed \$3 per cord.

Kingsley, Neal P., and David R. Dickson.

1969. **Pulpwood production in the Northeast—1967.** USDA

Forest Serv. Resource Bull. NE-13, 34 pp., illus. NE.
Forest Exp. Sta., Upper Darby, Pa.

An annual report based on canvasses of pulpwood producers in the Northeast. It contains data on round pulpwood production in the 14 Northeastern States by counties and species groups, and on pulpwood chip production and residue production. Comparisons are made with the previous year's production data. Trends in pulpwood production for the past 5 years are shown. This report also contains a list of active woodpulp mills in the Northeast.

Lindmark, Ronald D., and Paul S. DeBald.

1969. **Black walnut on nonforest land in Kentucky.** USDA Forest Serv. Resource Bull. NE-16, 18 pp., illus. NE.
Forest Exp. Sta., Upper Darby, Pa.

A report of a survey of black walnut timber found on nonforest land in Kentucky. These trees add substantially to the State's overall supply of black walnut. Although the trees growing under nonforest conditions tend to be short-boled, many of them have large diameters and contain quality timber.

McCauley, Orris D., and Joseph J. Mendel.

1969. **Adjusting quality index log values to represent local and regional commercial sawlog product values.** USDA Forest Serv. Res. Paper NE-149, 28 pp., illus. NE.
Forest Exp. Sta., Upper Darby, Pa.

A study of hardwood log values determined by the quality-index (Q.I.) method provides a reliable estimate of log product values for logs of Forest Service factory grades F_1 and F_2 . But the Q.I. method underestimates the log-product value for logs of lower grades and classes. Methods for making the necessary value adjustments are given.

McCauley, Orris D., and David P. Worley.

1969. **An economic evaluation of precommercial thinning in predominantly paper birch stands.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 128-134.
Upper Darby, Pa.

A study of three precommercial thinning practices in a paper birch stand provided the necessary physical data for making an economic evaluation of some thinning alternatives. The practices considered were light thinning, species thinning, and heavy thinning.

McCay, Roger E.

1969. **Distributing value gain from three growth factors for yellow-poplar.** USDA Forest Serv. Res. Note NE-104, 8 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

A method of apportioning the maximum dollar value gain from tree growth into the amounts contributed by diameter growth, merchantable height increase, and quality improvement is

Northeastern Forest Experiment Station.

1970. 1969 at the Northeastern Station. USDA Forest
Serv. NE. Forest Exp. Sta., Upper Darby, Pa. 56 pp.

A report on the Station's activities and accomplishments in 1969,
plus an annotated list of publications during the year.

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A report on the Station's activities and accomplishments in 1969,
plus an annotated list of publications during the year.

described. The results of this method are presented for various sizes and qualities of yellow-poplar trees.

Mendel, Joseph J.

1969. **Financial maturity of paper birch.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 135-144. Upper Darby, Pa.

A system for the development by timber-growing firms of financial maturity guides for paper birch that will be most responsive to the needs and expectations of those firms. The financial maturity guides presented are the result of generalizations about mill recovery yields, prices, conversion costs, etc.; and they must be considered as regional guides.

Mendel, Joseph J., and George R. Trimble, Jr.

1969. **The rate of value increase for yellow-poplar and beech.** USDA Forest Serv. Res. Paper NE-140, 27 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Expected rates of value increase over a 10-year period are presented for yellow-poplar and beech sawtimber trees, based on tree-growth and tree-quality data collected in West Virginia. From these expected rates, marking guides were developed, based on the financial maturity concept.

Quigley, Kenneth L., and Harold M. Babcock.

1969. **Birch timber resources of North America.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 6-14, illus. Upper Darby, Pa.

A review of the yellow birch and paper birch timber resources of North America. The range, cover types, sawtimber volume, growing-stock volume, annual growth, annual harvest, and resource outlook for both yellow and paper birch are discussed.

Quigley, Kenneth L., and James T. Morgan.

1969. **Sugar maple timber resources.** USDA Forest Serv. NC. Forest Exp. Sta. Sugar Maple Conf. Proc.: 3-8, illus. St. Paul, Minn.

Most sugar maple volume is in the maple-beech-birch type, which accounts for about 9 percent of all forest land in the East. Sugar maple accounts for about 4 percent of sawtimber volume in the eastern United States; most volume is in trees less than 17 inches d.b.h., and less than half is in the better quality log grades. The supply of sugar maple sawtimber is increasing, but good sawtimber will be scarce in the future unless the methods of growing and managing sugar maple timber are improved.

Trimble, George R., Jr., and Joseph J. Mendel.

1969. **The rate of value increase for northern red oak, white oak, and chestnut oak.** USDA Forest Serv. Res. Paper NE-129, 29 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Financial maturity, the point at which trees cease to earn an adequate return and should be cut, is an important factor in deciding when trees and stands should be cut. Financial maturity information, based on tree-growth and tree-quality data, and means of determining financial maturity are presented.

Worley, David P.

1969. **The landowner — his objectives and some management implications.** USDA Forest Serv. NE. Area S&PF CFM Conf. Proc.: 1-11.

The objectives of owners of small woodlands and their implications for forest management are examined. Suggests that the owner's objectives for his land should guide the forester in determining best management practices, but the forester should help the owner determine those objectives.

FOREST INSECTS

Burns, Denver P.

1969. **Defects caused by primary borers in white oak.** (Abstr.) Entomol. Soc. Amer. NC. States Br. Proc. 24: 39.

A discussion of the way primary borers attack and damage white oaks.

Chapman, R. C.

1969. **Modeling forest insect populations—the stochastic approach.** In **Forest insect population dynamics.** USDA Forest Serv. Res. Paper NE-125: 73-88. NE. Forest Exp. Sta., Upper Darby, Pa.

Empirical (predictive) models and rational (mechanistic) models, both deterministic and stochastic, are essential to the development of good population models. The complex inter-relationships that we wish to understand require the abilities of both the statistician and the biologist to design the studies needed to gain deeper insight into biological phenomena.

Campbell, Robert W.

1969. **Studies on gypsy moth population dynamics.** In **Forest insect population dynamics.** USDA Forest Serv. Res. Paper NE-125: 29-34. NE. Forest Exp. Sta., Upper Darby, Pa.

Life tables for the gypsy moth were accumulated over 53 generation-years from an area in northeastern New York between

1958 and 1963. Analyses of the data, which are in tabular form, are presented.

Conklin, James G.

1969. **Insect enemies of birch.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 151-154. Upper Darby, Pa.

The author discusses a few representative kinds of insects that cause particular types of injury to birch trees and indicates their relative importance and the needs for control.

DeMars, C. J., Jr.

1969. **Quality control in entomological sampling.** (Abstr.) In **Forest insect population dynamics.** USDA Forest Serv. Res. Paper NE-125: 97-99. NE. Forest Exp. Sta., Upper Darby, Pa.

The various elements that enter into effective ecological sampling—accuracy, precision, efficiency, biological relevance, and ecological integrity of the system—are defined and illustrated.

Donley, D. E., C. J. Hay, and D. P. Burns.

1969. **Borers in Ohio oaks.** Ohio Woodlands 7(4): 17-18, illus.

A review of the various boring insects that attack white and red oak trees in Ohio. The life-cycle of each insect and the damage it causes are described.

Donley, David E.

1969. **Oviposition behavior of *Goes tigrinus* DeG. in white oak (*Quercus alba* L.).** (Abstr.) Entomol. Soc. Amer. NC. States Br. Proc. 24: 39.

The results of laboratory mating and oviposition of a white oak borer, *Goes tigrinus* DeG., are illustrated and discussed. Oviposition and larval survival are discussed, based on examination of 180 white oaks (*Quercus alba* L.).

Drooz, A. T.

1969. **Population density and insect biology: a review.** In **Forest insect population dynamics.** USDA Forest Serv. Res. Paper NE-125: 113-126. NE. Forest Exp. Sta., Upper Darby, Pa.

A review of progress and trends in population density and insect biology research, beginning with the work of Uvarov in 1921. To construct meaningful population models, research will have to be strengthened by the inclusion of other disciplines, and a carefully structured team approach should be developed.

Galford, Jimmy R.

1969. **Artificial rearing of 10 species of wood-boring insects.**

USDA Forest Serv. Res. Note NE-102, 6 pp. NE.
Forest Exp. Sta., Upper Darby, Pa.

Small numbers of 10 species of wood-boring insects were reared from newly hatched larvae to adults on artificial media with good survival. Species with life cycles of up to 2 years in nature were reared on the media in less than 1 year. Although all of the adults appeared normal physically, some were sterile. One species was reared artificially for three generations. Survival figures and the developmental periods of the larval stages are given.

Galford, Jimmy R.

1969. **A larval and ovipositional medium for the smaller European elm bark beetle.** J. Econ. Entomol. 62: 1166-1168, illus.

Two artificial media for *Scolytus multistriatus* (Marsham) that contained wheat germ as the only major source of nutrition proved suitable for larval development and oviposition of viable eggs. The media differed mainly in the type of microbial inhibitors. Two complete generations of *S. multistriatus* were reared on the media.

Hay, Cyrus J.

1969. **Relating the life history of a red oak borer to its behavior in red, black, and scarlet oak.** (Abstr.) Entomol. Soc. Amer. NC. States Br. Proc. 24: 39.

Field observations made in south-central Ohio and eastern Kentucky relate to detection signs of attack sites by a red oak borer, *Enaphalodes rufulus* (Haldeman). The borer has a 2-year synchronated life cycle, with adult emergence in odd numbered years. The observed development of the life stages is depicted on a month-by-month basis.

Hay, C. John.

1968. **The red oak borer, biological notes and a possible silvicultural control method.** (Abstr.) Entomol. Soc. Amer. NC. States Br. Proc. 23: 46-47.

In southeastern Ohio and eastern Kentucky, the red oak borer is the primary cause of serious degrade in sawlogs of red, black, and scarlet oak. Because it has a 2-year life cycle, logging and timber-stand-improvement work in infested stands should be properly timed.

Knight, P. B.

1969. **Some practical field problems associated with sampling of scarce insects. In Forest insect population dynamics.** USDA Forest Serv. Res. Paper NE-125: 89-96. NE. Forest Exp. Sta., Upper Darby, Pa.

Many problems are associated with the sampling of scarce insects: measurement of population numbers, identification of mortality factors, and destruction of the population by sam-

pling are some examples. In some ways we have gone too far in our enthusiasm for exact quantitative data. We must thoroughly understand the ecology of the insect and the host if we are to solve the population problems.

Morris, R. F.

1969. **Approaches to the study of population dynamics. In Forest insect population dynamics.** USDA Forest Serv. Res. Paper NE-125: 9-28, illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The "life-table," "key factor," and "process" approaches are described; and an example of an approach is given in a discussion of work with the fall webworm, *Hyphantria cunea*.

Mott, D. Gordon.

1969. **Dynamic models for population systems.** In **Forest insect population dynamics.** USDA Forest Serv. Res. Paper NE-125: 53-73. NE. Forest Exp. Sta., Upper Darby, Pa.

The mathematical structures of some forms of dynamic system models are described. A system model will give the best possible guide to system dynamics research by focusing effort on the measurement of important system parameters rather than permitting reliance on intuition.

Mott, D. Gordon.

1969. **Book review of "Ecology of insect vector populations."** Sci. 164: 941.

The book is a review of sampling methodology for insect vector populations and is concerned mainly with the mechanical and biological aspects of obtaining samples. It summarizes many of the facts needed to design statistical sampling plans, but its greatest value lies in its demonstration of the improvements needed—the inadequate knowledge of such basic facts as life histories, reproductive and survival capacities, and relative abundance of most of the important vectors.

Northeastern Forest Experiment Station.

1969. **Forest insect population dynamics.** USDA Forest Serv. Res. Paper NE-125. 126 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Contains 10 papers presented at the forest insect population dynamics workshop held at West Haven, Conn., 23-27 January 1967. Individual papers are listed separately.

Northeastern Forest Experiment Station.

1969. **So, who needs persistent pesticides?** Amer. Christmas Tree J. 13(4): 7-9, illus.

Research designed to develop a virus that will control the European pine sawfly is described. This natural control tech-

nique will regulate insect populations without the undesirable side effects of persistent pesticides.

Rexrode, Charles O.

1969. **Population increase of two species of *Pseudopityophthorus* in oak branches.** Ann. Entomol. Soc. Amer. 62(2): 448-449, illus.

A study to determine the fecundity and population increase of two oak bark beetles, *P. pruinus* and *P. minutissimus*, breeding in dead oak trees. The population increase was estimated by comparing the number of beetles that attacked a tree with the number of new adults that emerged.

Rexrode, Charles O.

1969. **Seasonal development and habits of *Pseudopityophthorus* Spp. (Coleoptera: Scolytidae) in southern Ohio.** Can. Entomol. 101: 306-313, illus.

Describes the seasonal history and habits of two oak bark beetles, *P. minutissimus* (Zimm.) and *P. pruinus* (Eichhoff), in 47 oaks in southern Ohio.

Waters, William E.

1969. **The life table approach to analysis of insect impact.** J. Forestry 67: 300-304.

Life tables provide a method of analyzing the relative importance of the interacting destructive and constructive forces operating on a forest system. Life-table data for forest stands may be used to reveal the critical age intervals and the factors or agents most important in determining yield and value. These data can also augment analytical schemes of forest regulation now in use. Two types of life table, and the way each can be developed to account for insect impacts on forest stands, are described.

Waters, William E.

1969. **Forest insect population dynamics—some basic considerations.** In **Forest insect population dynamics.** USDA Forest Serv. Res. Paper NE-125: 1-7, illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A general discussion of population-dynamics studies. If population regulation is an objective, we should use all knowledge gained of each insect population system to decide which path to follow: lowering the mean density level, reducing amplitude of the oscillations, extending the period between peaks of abundance, or any combination of these.

Watt, K. E. P.

1969. **Methods of developing large-scale systems models.** In **Forest insect population dynamics.** USDA Forest Serv. Res. Paper NE-125: 35-51. N.E. Forest. Exp. Sta., Upper Darby, Pa.

A discussion of the experimental-components approach for constructing a mathematical model of an insect population. The processes of experimentation and mathematical model construction are conducted as two interlocking parts of an integrated program.

Wilson, Robert W., Jr.

1969. **Considerations of the relation of various errors to estimates of population dynamics.** In **Forest insect population dynamics.** USDA Forest Serv. Res. Paper NE-125: 101-111. NE. Forest Exp. Sta., Upper Darby, Pa.

The author defines sampling in general and sampling errors in particular, describes three significantly different types of sampling errors, shows how bias may enter sample estimates of one or another of the population parameters, and shows how bias in an estimate distorts judgments of the validity of estimates.

Wollerman, Edward H., Carol Adams, and George C. Heaton.

1969. **Continuous laboratory culture of the locust borer, *Megacyllene robiniae*.** Ann. Entomol. Soc. Amer. 62: 647-649.

Procedures are described for initiating and maintaining a laboratory culture of ***M. robiniae*** (Forster) (Coleoptera: Cerambycidae). The prepared food medium contains agar, water, cellulose, black locust powder, wheat germ, sucrose, casein, Wesson's salts, choline chloride, ascorbic acid, methyl and butyl parahydroxybenzaldehyde, sorbic acid, and a vitamin mixture. Seven generations have been reared in the study.

FOREST DISEASES

Berry, Frederick H.

1969. **Decay in the upland oak stands of Kentucky.** USDA Forest Serv. Res. Paper NE-126, 16 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Although 22 different species of fungi were found associated with decay in upland oak stands of Kentucky, these 4 were most commonly encountered in a study of 1,490 trees: ***Polyporus compactus***, ***Stereum frustulatum***, ***S. gausapatum***, and ***Poria cocos***. Fire scars were the most important means of entry of the decay fungi, and decay volume was found to increase progressively with age and diameter.

Dochinger, Leon S.

1969. **A progress report on three problems in Ohio forest nurseries.** USDA Forest Serv. NE. State & Private Forestry Nurserymen's Conf. Proc. 20: 62-69.

In Ohio forest nurseries, a program is under way to determine (1) the cause and control of a root rot of eastern white pine; (2) the effects of white pine parentage, seedling characteristics, and site upon the appearance of chlorotic dwarf trees; and (3) the control of Marssonina leaf blight of bigtooth aspen with fungicidal sprays.

Dochinger, L. S.

1969. **Agrobacterium gall of hybrid poplar trees in Iowa.** (Abstr.) Phytopathol. 59: 1024.

Agrobacterium galls were observed on three natural hybrids of poplars. Tests show that this **Agrobacterium** species is a potential threat to plantations and natural stands of poplar and other tree species.

Dochinger, L. S., and W. W. Heck.

1969. **An ozone-sulfur dioxide synergism produces symptoms of chlorotic dwarf of eastern white pine.** (Abstr.) Phytopathol. 59: 399.

Chlorotic dwarf of eastern white pine results from air pollution injury to foliage of genetically susceptible trees.

Gregory, Garold F.

1969. **A technique for inoculating plants with vascular pathogens.** Phytopathol. 59: 1014, illus.

A technique is described for inoculating plants with vascular pathogens, using serum vial stoppers as a reservoir for the inoculum suspension and a relatively nontoxic and fast-acting adhesive. The method reported here is adapted to small plants, as well as to quantitative uptake of inoculum suspensions. This technique has been used to inoculate elms and tomatoes; however, most work has been with young oak seedlings inoculated with oak wilt fungus.

Gregory, G. F.

1969. **Production and partial purification of a toxin produced in vitro by Ceratocystis fagacearum.** (Abstr.) Phytopathol. 59: 399.

C. fagacearum, the oak wilt pathogen, grown on two synthetic media, produced a toxin that caused a wilting syndrome, resembling that of oak wilt, on oak seedlings.

Gregory, G. F., and P. McWain.

1969. **General characteristics of a toxin produced by Ceratocystis fagacearum.** (Abstr.) Phytopathol. 59: 399.

A toxin produced *in vitro* by **C. fagacearum** causes drying of the leaves of oaks.

Heck, Walter W., and Leon S. Dochinger.

1969. **Pollution dwarfs white pines.** Agr. Res. 18(2): 4, illus. Air pollution, at relatively low levels, causes chlorotic dwarf disease in eastern white pine. Scientists of the USDA Forest Service and Agricultural Research Service, in cooperation with the National Air Pollution Control Administration of the Department of Health, Education, and Welfare, are studying the disease.

Houston, David R.

1969. **Basal canker of white pine.** Forest Sci. 15: 66-83, illus. Studies were performed to determine the etiology of a basal canker disease of eastern white pine. Inoculation of healthy seedlings with several fungi isolated from natural cankers resulted in cankers. Injuries near the ground line created by ants, primarily **Formica fusca**, and by snow and ice, served as infection courts for the fungi.

Houston, David R.

1969. **The dieback and decline of northeastern hardwoods.** Pa. Forests 59(1): 18-20, illus.

Discusses symptoms, causes, occurrence, and prevention of dieback and decline in northeastern hardwoods. The symptoms exhibited by declining trees reflect host response to the stress of an adverse environmental change compounded by the inroads of various organisms. Because affected trees are first weakened by stress, measures to prevent the stress would be beneficial.

Houston, David R., and Harold G. Eno.

1969. **Use of soil fumigants to control spread of Fomes annosus.** USDA Forest Serv. Res. Paper NE-123, 23 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A series of preliminary experiments was made with soil fumigants to test the hypothesis that a continuous zone of roots rendered unsuitable for invasion by **Fomes annosus** will prevent the underground spread of this fungus from diseased to healthy trees.

Jensen, Keith F.

1969. **Effect of constant and fluctuating temperature on growth of four wood-decaying fungi.** Phytopathol. 59: 645-647, illus.

Temperature fluctuations of plus and minus 3°C. and 6°C. around a temperature mean of 21°C. increased growth of four wood-decaying fungi, while a fluctuation of plus and minus 11°C decreased their growth. Part of these responses was due to the additive effects of the separate temperatures in the regimes, but some stimulation by fluctuating temperature was found.

Jensen, Keith F.

1969. **Oxygen and carbon dioxide concentrations in sound and decaying red oak trees.** Forest Sci. 15: 246-251, illus.

Oxygen concentrations in stems of red oak trees were usually less than 2 percent in sound trees and less than 4 percent in decayed trees. Carbon dioxide concentrations varied between 14 to 20 percent in sound trees and between 7 and 21 percent in decayed trees. No distinct relationships were found between gas concentration and season, height, or depth in the trees. The significance of these findings in relation to the activity of wood-decaying fungi is discussed.

Jensen, K. F.

1969. **Relationships between the polygalacturonase produced by *Fusarium solani* and pH.** (Abstr.) Phytopathol. 59: 1033.

Polygalacturonase activity reached a maximum after 7 days of growth and was higher from a medium with a pH of 4. The polygalacturonase system was stable below pH 6 and had a pH optimum of 5.5-6.0.

Jensen, Keith F., and Phillip E. Reynolds.

1969. **How two types of fluctuating temperature affect the growth of *Fusarium solani*.** USDA Forest Serv. Res. Note NE-105, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Growth of six isolates of *Fusarium solani* on potato dextrose agar was determined with (1) continually changing temperature programs, (2) programs consisting of two alternating constant temperatures, and (3) a constant temperature program. All programs had a mean of 70° F. Growth increased with an increase in temperature fluctuation of 10 or 20° F., but decreased with a fluctuation of 40° F. Significant differences were found in the growth rates of the isolates.

Shigo, Alex.

1969. **The death and decay of trees.** Natur. Hist. 78(3): 42-47, illus.

How diseases begin after a tree is wounded, how they eventually progress to the decay stage, and how a tree responds to wounds and infections by forming protective barriers to keep out invading microorganisms are discussed and explained. In beech, birch, and maple the pioneer microorganisms that infect wounds are bacteria and non-decay fungi, either separately or together. The tissues altered by these organisms become potential food for other microorganisms, and decay fungi enter.

Shigo, Alex L.

1969. **Diseases of birch.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 147-150. Upper Darby, Pa.

Diseases are a major cause of damage to birch, and discoloration and decay are the major internal defects that are associated with them and that lower the quality of the wood. High-quality birch can be grown only if more attention is given to these defects. And this can be achieved only through an increased understanding of the defects and the processes that bring them about.

Shigo, Alex L.

1969. **How *Poria obliqua* and *Polyporus glomeratus* incite cankers.** *Phytopathol.* 59: 1164-1165, illus.

These fungi form a sterile conk, the leading edges of which penetrate the outer bark. The pressure of the advancing margin of the sterile conk kills the cambium and results in the formation of a canker.

Shigo, Alex L., and Edwin vH. Larson.

1969. **A photo guide to the patterns of discoloration and decay in living northern hardwood trees.** USDA Forest Serv. Res. Paper NE-127, 100 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

This guide (100 full-color photos) illustrates how discoloration and decay form in northern hardwood trees, and shows how the severity and extent of interior defect can be estimated from external indications on the living tree. The defects are limited to a column the size of the tree at the time the tree was injured. Branch stubs are the main entry point for the agents that initiate the discoloration and decay processes.

FOREST PRODUCTS MARKETING & UTILIZATION

Bent, John E.

1969. **Some benefits, problems, and concerns of a secondary user of yellow birch.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 38-39. Upper Darby, Pa. S. Bent & Brothers, of Gardner, Mass., who specialize in manufacturing early American chairs, prefer yellow birch for most parts except where there is a critical bending problem, for which they prefer rock maple. The birch is easier to dry than maple, presents fewer problems in checking, and machines and finishes well.

Carpenter, Roswell D.

1969. **Bolt, log, and tree grades for birch.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 26-32, illus. Upper Darby, Pa.

A description of the bolt, log, and tree-grading systems for birch. Research being conducted on hardwood grading systems by the Northeastern Forest Experiment Station, USDA Forest Service is discussed.

Church, Thomas W., Jr.

1969. **Don't leave your defective maple butts in the woods.** N. Logger 17(11): 24-25, 39, illus.

Most internally defective sugar maple butts can be harvested and sawed profitably. High lumber values in the shell of sound wood allow utilization of log sections otherwise considered cull. Since unprofitable logs cannot be positively identified, defective maple butts that have a 6-inch collar of sound wood surrounding internal flaws should be harvested.

Dempsey, Gilbert P., and Clyde B. Markeson.

1969. **Guidelines for establishing forestry cooperatives.** USDA Forest Serv. Res. Paper NE-133, 38 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Anyone who considers starting a forestry cooperative should first analyze the prospects in a businesslike way and anticipate the problems that have beset previous cooperatives. The main factors that should be considered include membership and participation, financing, raw-material supply, markets, labor and management, and legal aspects.

Ellefson, Paul V., and Gilbert P. Dempsey.

1969. **Promotion: A step toward sound Christmas tree marketing.** Amer. Christmas Tree J. 13(3): 49-53, illus.

A well-developed promotional campaign aimed at the right audience via the right media promises increased sales and satisfied customers. Advertising, packaging, and product or brand identification have broad economic implications for the Christmas tree industry.

Gammon, Glenn L.

1969. **Specific gravity and wood moisture variation of white pine.** USDA Forest Serv. Res. Note NE-99, 6 pp., illus. NE. Forestry Exp. Sta., Upper Darby, Pa.

A report on results of a study to develop a means for estimating specific gravity and wood moisture content of white pine. No strong relationships were found by using either the single or combined factors of age and dimensional stem characteristics. Inconsistent patterns of specific gravity and moisture over height in a tree are graphically illustrated.

Garrett, Lawrence D.

1969. **Economic implications of manufacturing sawed ties and timbers.** USDA Forest Serv. Res. Paper NE-148, 24 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

If markets for sawed timbers are available, Appalachian sawmill operators normally can expect a greater income from the combined production of lumber and timbers than from lumber production alone. Increased hourly income from sawed timbers ranged from \$5 to \$10. The bonus values were greatest when timbers were sawed from the poorest sound logs of the least valuable species.

Hanks, Leland F.

1969. **Which indicator is best—a preview of hardwood tree grades.** (Abstr.) Soc. Amer. Foresters 1968 Annu. Meeting Abstr. Papers: 13.

A discussion of the research to determine which indicator section should be used in tree grading and which would be the most useful in predicting value per million board feet.

Lucas, Edwin L.

1969. **An approach to yellow-poplar tree valuation.** USDA Forest Serv. Res. Paper NE-137, 13 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Equations were developed that, when applied to yellow-poplar trees in Illinois, Kentucky, and Ohio, predicted a value of lumber yield within 2 percent of the value computed from log yields. To use the method, only three tree characteristics are needed: diameter breast height, merchantable height, and the number of 5-foot clear cuttings on the four faces of the 16-foot butt log. The results show that a workable system of tree valuation based on continuous prediction can be developed.

Lucas, John T.

1969. **Use of wooden pallets in the brewing industry.** USDA Forest Serv. Res. Paper NE-132, 17 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

By means of personal interviews with materials-handling officials in nine large U.S. breweries, the author analyzed the market for wooden pallets in terms of: (1) location and characteristics of the industry, (2) pallet-purchasing practices, (3) types of pallets in use, (4) pallet life and repair, (5) palletized handling systems, and (6) the future role of wooden pallets in the industry.

Lucas, John T., and Walter B. Wallin.

1969. **The Department of Defense market for wooden pallets: 1966.** USDA Forest Serv. Res. Paper NE-122, 19 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The Department of Defense market for wooden pallets is described: the kinds and quantities of pallets needed, when and where pallets are needed, how the pallets are purchased, sources of pallet supply, and pallet prices.

Lucas, John T., and Walter B. Wallin.

1969. **The Department of Defense market for wooden pallets: 1967.** USDA Forest Serv. Res. Paper NE-131, 20 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

The Department of Defense market for wooden pallets in 1967 is described: the kinds and number of pallets needed by DOD and DOD procurement practices are discussed. The report compares the 1967 market to the 1965 and 1966 markets.

McDonald, Clark E.

1969. **Birch veneer & plywood demand—projected needs of the industry.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 15-25. Upper Darby, Pa.

The supply of birch veneer logs from both old-growth stands and from stands that originated after heavy cuttings at the turn of the century is rapidly being exhausted. The situation will probably get worse before it gets better. Data on imports and domestic uses.

Nolley, Jean W.

1969. **Christmas tree marketing: a bibliography.** Amer. Christmas Tree J. 13(2): 23-26.

An annotated bibliography of recently published information from 21 major publications about the Christmas tree industry, production, management practices, silviculture, marketing, and consumption.

Norton, Kenneth, and Harold B. Gatslick.

1969. **Potential of low temperature drying of eastern spruce and eastern hemlock.** Forest Prod. J. 19 (10): 33-36.

Eastern spruce and hemlock stock was successfully dried in a low-temperature dryer; best results were obtained at 100°F., 10 percent e.m.c., and air speed of 500 f.p.m. Although low-temperature drying of spruce and hemlock lumber cannot be economically justified in light of market practices, it could be useful where air-drying space is scarce or a regular year-round supply of air-dry material is needed.

Pendleton, Thomas H.

1969. **Sales promotion in the natural Christmas tree industry.** Amer. Christmas Tree J. 13(1): 3-6, illus.

Sales promotion can help the natural tree industry combat the effects of competition from the artificial Christmas tree industry. Several techniques for promoting sales are suggested.

Pendleton, Thomas H., and Lawrence D. Garrett.

1969. **"O Tannenbaum, O Tannenbaum," how phony all your needles are!** S. Lumberman 219(2728): 128-129, illus.

A report on the growth of the artificial Christmas tree industry: size of the market, factors responsible for the growth in sales, and innovations expected in artificial trees in the next few years.

Pendleton, Thomas H., and Lawrence D. Garrett.

1969. **Competition: The artificial Christmas tree industry.** Cornell Univ. Sch. Christmas Tree Growers Proc.: 51-59.

A description and analysis of the artificial Christmas tree industry, including a history of the artificial Christmas tree, a discussion of the nature and size of the present market and projections for the 1970's, and a description of the industry's production and distribution systems.

Reynolds, Hugh W.

1969. **The SHOLO (SHOrt LOg) Mill.** S. Lumberman 219 (2728): 182-185, illus.

The SHOLO mill is a new system for using low-grade logs to produce flooring and pallet parts at low cost. Costs required to build and operate such a mill are estimated, and the estimated rate of return is predicted.

Reynolds, Hugh W., and Charles J. Gatchell.

1969. **Sawmill simulation: concepts and computer use.** USDA Forest Serv. Res. Note NE-100, 5 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Product specifications were fed into a computer so that the yield of products from the same sample of logs could be determined for different simulated sawing methods. Since different sawing patterns were tested on the same sample, variation among log samples was eliminated; hence, the statistical conclusions are very precise.

Sarles, R. L., and E. vH. Larson.

1969. **High costs of improper seasoning.** Woodworking Dig. 71 (7): 34-35, illus.

Good seasoning is important to the best use and marketing of hardwood lumber. Improperly seasoned lumber costs more to ship because of the weight of extra moisture content; rushed dry-kiln schedules lead to excessive degrade in poorly dried lumber; and poorly seasoned lumber results in wood waste and defective parts and assemblies. A key to the success of the hardwood lumber producer is to have well-seasoned lumber available at all times in the right species, thicknesses, and grades to meet the demands of the market.

Saunders, Henry W.

1969. **Primary utilization of birch.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 33-37, illus. Upper Darby, Pa.

Saunders Brothers, who manufacture hardwood dowels and other turned products, require high-quality short bolts rather than long logs. Raw-material procurement, manpower, and equipment are described, including a new sawmill with a 4-saw headrig that is expected to substantially increase the yield of dowel slats.

Stern, E. George.

1969. **Rigidity of 48" by 40" lumber pallets.** Va. Polytech. Inst. Res. Div. Wood Res. & Wood Constr. Lab. Misc. Bull. 78: 15 pp.

Data from free-fall drop tests were performed on four types of pallets to measure their rigidity and to test the effectiveness of four types of nails. Tests indicated that helically threaded hardened-steel pallet nails provided considerably more rigidity than the other types tested.

Stern, E. George.

1969. **Rigidity of 48" by 40" lumber pallets.** Part II. Va. Polytech. Inst. Res. Div. Wood Res. & Wood Constr. Lab. Misc. Bull. 79: 15 pp.

Free-fall drop tests were performed on four pallet designs to evaluate their rigidity and the effect of the number of nails used. Four nails instead of three per corner joint of 1-by-6-inch end top deck-board and stringer resulted in pallets of 16 percent higher rigidity.

Stern, E. George.

1969. **Rigidity of 48" by 40" plywood and lumber-mat pallets.** Va. Polytech. Inst. Res. Div. Wood Res. & Wood Constr. Lab. Misc. Bull. 81: 15 pp.

Free-fall drop-test data for three plywood pallet designs and a lumber-mat pallet design are evaluated. Hardened-steel nails should be used for the assembly of lumber pallets and stiff-

stock nails should be used instead of hardened-steel nails for the assembly of plywood pallets. Minor changes in design are recommended.

Stern, E. George.

1969. **Up-grading of pallets by assembly with hardened-steel nails.** Va. Polytech. Inst. Res. Div. Wood Res. & Wood Constr. Lab. Misc. Bull. 83: 31 pp.

Use of hardened-steel helically threaded 2.5- by 0.120-inch pallet nails increased the rigidity of fully matched, nonreversible, double-face and flush 48- by 40-inch unused permanent warehouse pallets by 65 percent regardless of whether the pallets were made of red oak, southern pine, or red pine lumber.

Stern, E. George.

1969. **Rigidity of 48" by 40" Douglas fir lumber and plywood pallets.** Va. Polytechnic Inst. Res. Div. Wood Res. & Wood Constr. Lab. Misc. Bull. 84: 15 pp.

Four designs of Douglas-fir lumber and plywood pallets subjected to free-fall drop tests surpassed rigidity criteria based on the arbitrary 5-percent distortion limit. The lumber pallets were of medium rigidity, and the plywood pallets were extremely rigid.

Strobel, John J., and Walter B. Wallin.

1969. **The unit-load explosion in the food industry.** U.S. Forest Serv. Res. Paper NE-121, 60 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Analysis of more than 2,700 shipments of products from more than 400 manufacturers to 10 major food-distribution centers showed that handling and shipping efficiency varies by type of product, by handling system, and by practices and policies of both shipper and receiver. The wooden pallet was found to be the most prevalent and most efficient system for unit-load handling. However, a national pallet-exchange program and standards for pallet quality are essential.

Tabor, D. W., and J. E. Shottafor.

1969. **The market potential for eastern spruce plywood.** Univ. Maine Sch. Forest Resources Bull. 674, 39 pp., illus.

A survey of architectural and construction firms in the Northeast shows that there is a potential market for decorative and structural plywood made from the eastern spruces.

Wallace, Oliver P.

1969. **Management of birch for other uses.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 176-177. Upper Darby, Pa.

Marketing practices that allow intensified management for birch timber will also improve other forest land benefits, and

the aesthetic and scenic qualities of our woodlands will be increased. More important, higher prices for wood will make possible specific management for those other amenities that our population increasingly demands.

Wolf, Charles H., and Jeffrey L. Wartluft.

1969. **Hardwood bark . . . from nuisance to nest egg.**

N. Logger 18(2): 20, 21, 66-68, illus.

A discussion of how sawmill, pulpmill, and veneer-plant operators might produce bark products to reduce disposal problems and to increase profits. Alternatives of processing and marketing are discussed, as well as aspects of the bark-product market.

WATERSHED MANAGEMENT

Aubertin, Gerald M.

1969. **An improved technique for taking hydraulic conductivity cores from forest soils.** USDA Forest Serv. Res. Note NE-92, 4 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A large-diameter, heavy-duty soil sampler makes it possible to obtain long and relatively undisturbed sample columns from stony root-filled forest soils. The samples include the roots, root channels, stones, and macro-voids common to forested soils.

Berg, W. A.

1969. **Determining pH of strip-mine spoils.**

USDA Forest Serv. Res. Note NE-98, 7 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

Results with the LaMotte-Morgan method for determining soil pH—or the solution modification of this method—usually agreed fairly well with results obtained using a pH meter, the recognized standard. Results obtained with the Soiltex and Hellige-Truog methods often deviated somewhat from the pH meter readings, and the Hydrion papers and the Kelway pH tester often gave results that were considerably different.

Berg, W. A., and R. F. May.

1969. **Acidity and plant-available phosphorus in strata overlying coal seams.** Mining Congr. J. 55(3): 31-34, illus.

A study was made of the position of extremely acid strata and the amount of plant-available phosphorus in the overburden of six coal strip mines in Kentucky. Results suggest methods of identifying certain acid strata and ways to strip and grade so that the acid material is buried.

Bormann, F. H., G. E. Likens, and J. S. Eaton.

1969. **Biotic regulation of particulate and solution losses from a forest ecosystem.** *Biosci.* 19: 600-610, illus.

Studies in the Hubbard Brook Experimental Forest show that total particulate matter losses from an undisturbed forest ecosystem were 2.5 metric tons/km²/year. Total output of dissolved substances was 14 metric tons/km²/year. Both values were considerably below amounts reported for similar regions.

Czapowskyj, Mirosław M.

1969. **Anthracite coal-mine spoils today—forests tomorrow.** *Pa. Forests* 59(3): 81-83, illus.

A history of attempts to revegetate coal-mine spoils in the Anthracite Region and a review of the state of research on revegetation.

Czapowskyj, Mirosław M.

1969. **Book review of "Forest fertilization—theory and practice."** *Soil Sci.* 107: 311.

The book consists of papers delivered at a 1968 symposium devoted to forest fertilization. It gives a comprehensive review of the current knowledge on forest fertilization by 48 scientists in soils, plant physiology, chemistry, and forestry. The volume contains much information of special interest to researchers in forest fertilization, forest management, and the fertilizer industry.

Federer, C. A.

1969. **New landmark in the White Mountains.** *Appalachia* 37: 586-594, illus.

A discussion of the cleared watershed experiment at Hubbard Brook Experimental Forest. Includes a history of the Hubbard Brook watershed and of the early U.S.G.S. hydrologic studies in the White Mountains.

Federer, C. A.

1969. **Reduction of summer city temperatures by trees.** (Abstr.) *Soc. Amer. Foresters 1968 Annu. Meeting Abstr. Papers*: 27.

The higher summer temperatures in cities may be reduced by increasing the number of trees in the city.

Hewlett, John D., Howard W. Lull, and Kenneth G. Reinhart.

1969. **In defense of experimental watersheds.** *Water Resources Res.* 5(1): 306-316.

Recent criticisms discount the contribution of experimental watersheds to the science of hydrology and to watershed management. By reference to recent and older results, the authors argue that the experimental watershed method has produced much of our present knowledge about the land phase of the hydrologic cycle and man's influence on it, and that the method is sound.

Hornbeck, James W., and Charles A. Troendle.

1969. **Effects of abandoned farmland on streamflow.** W. Va. Agr. and Forestry 2(1): 9-10, illus.

A study of streamflow indicates that water quality greatly improves after farm abandonment on steep slopes in West Virginia. The watersheds studied healed naturally and, during most of the study period, produced only slightly higher turbidities than undisturbed forested land. There was no significant increase or decrease in streamflow as the watersheds reforested.

Leaf, Albert L., and Raymond E. Leonard.

1969. **Forest fertilization, the environment, and total dry-matter production.** S. Lumberman 219 (2720): 24-26.

When used appropriately on nutrient-deficient sites, fertilization markedly influences the microclimate of the site. The change in dry-matter production due to fertilization appears to result in a shift in the interaction among the environmental components of the plantation. Changes in radiation balance are demonstrated.

Leonard, Raymond E.

1969. **Forests and noise abatement.** (Abstr.) Soc. Amer. Foresters 1968 Annu. Meeting Abstr. Papers: 27.

A discussion of the physical basis of noise propagation and the effect of trees on noise abatement.

Likens, Gene E., F. H. Bormann, and Noye M. Johnson.

1969. **Nitrification: Importance to nutrient losses from a cut-over forested ecosystem.** Sci. 163: 1205-1206.

The nitrate concentration in stream water from an experimentally deforested watershed increased from 0.9 mg. per liter before removal of the vegetation to 53 mg. per liter 2 years later. This nitrate mobilization, presumably due to increased microbial nitrification, was equivalent to all the other net cationic and anionic decreases observed in the drainage water.

Lull, Howard W.

1969. **Hydrologic effects from urbanization of forested watersheds in the Northeast.** (Abstr.) Soc. Amer. Foresters 1968 Annu. Meeting Abstr. Papers: 25-26.

A theoretical example of the effects of urbanization on forested watersheds shows that the imposition of impervious cover

reduced annual potential evapotranspiration while increasing annual runoff.

Lull, Howard W.

1969. **Book review of "Christians and the good earth."** J. Soil and Water Conserv. 24(5): 198-199.

The book consists of papers delivered at a conference of clergymen and conservationists devoted to conservation problems and the development of a theology of nature. It comes to no agreement on a theology of nature, but the volume discusses a wide range of questions about conservation and its relationship to religion.

Lull, Howard W., and William E. Sopper.

1969. **Hydrologic effects from urbanization of forested watersheds in the Northeast.** USDA Forest Serv. Res. Paper NE-146, 31 pp., illus. NE Forest Exp. Sta., Upper Darby, Pa.

Urbanization of forest areas tends to reduce interception, reduce infiltration and increase overland flow, reduce soil-moisture storage, reduce evapotranspiration, increase runoff, increase peak flows, and reduce water quality. Annual maximum peak flows, annual hydrologic responses, and annual runoff were found to increase with progressive urbanization.

Meehan, W. R., W. A. Farr, D. M. Bishop, and J. H. Patric.

1969. **Some effects of clearcutting on salmon habitat of two southeast Alaska streams.** USDA Forest Serv. Res. Paper PNW-82, 45 pp., illus. Pacific Northwest Forest & Range Exp. Sta., Portland, Ore.

The effects of clearcutting on streamflow, suspended sediment, stream temperature, log-debris jams, and indirectly on salmon populations of two watersheds were evaluated and compared with an uncut watershed in southeastern Alaska. Although some effects were observed, the timber harvest as practiced on these watersheds did not appear to harm salmon habitat or populations.

Patric, James H.

1969. **Changes in streamflow, duration of flow, and water quality of two partially clearcut watersheds in West Virginia.** (Abstr.) Amer. Geophys. Union Trans. 50 (4): 144.

Clearcutting the lower and upper halves of two watersheds resulted in annual streamflow increases of 4 to 8 inches. No relation between the increases and the sites was apparent.

Patric, J. H., and John Campbell.

1969. **A substitute for 2,4,5-T in eastern hardwood sprout and brush control.** NE. Weed Contr. Conf. Proc. 23: 320-328.

Two experimental watersheds on the Fernow Experimental Forest were clearcut and maintained barren with 2,4-D and 2,4,5-T. When 2,4,5-T was unavailable, a mixture of TBA, 2,4-D, and 2,4-DP was substituted. Under our conditions of use, the substitute was as effective and economical as 2,4-D and 2,4,5-T for controlling revegetation in eastern hardwoods.

Patric, James H., and Burley D. Fridley.

1969. **A device for measuring soil frost.** USDA Forest Serv. Res. Note NE-94, 7 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A water-filled plastic tube buried vertically in the soil in a copper casing permitted repeated observation of frost depth without damaging the sampling site. The device is simple and inexpensive and provides data on soil freezing at least as accurate as direct observation by digging through frozen soil.

Pierce, Robert S.

1969. **Forest transpiration reduction by clearcutting and chemical treatment.** NE. Weed Contr. Conf. Proc. 23: 344-350.

A 39-acre forested watershed in the White Mountains of New Hampshire was treated to eliminate transpiration. All woody vegetation and timber were cut but not removed. The herbicide bromacil was then broadcast-sprayed and 2,4,5-T was mistblown on stump sprouts. Streamflow from the treated watershed increased up to five times the amount from adjacent untreated watershed during normally low-flow periods in late summer.

Pierce, R. S.

1969. **Setting the record straight.** Amer. Forests 75(8): 62.

A letter pointing out that pertinent facts were omitted from the digest of an article by Likens, Johnson, and Bormann in the May 1969 issue of American Forests on drainage of water from a clearcut area on the Hubbard Brook Experimental Forest.

Plass, William T.

1969. **Pine seedlings respond to liming of acid strip-mine spoil.** USDA Forest Serv. Res. Note NE-103, 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A greenhouse trial was made to determine the effect of three rates of liming on the growth of five species of pine seedlings in an extremely acid strip-mine spoil. Liming at the rate of 5 tons per acre-foot significantly increased the growth of four of the species. Tissue analysis indicated the growth rate may be related to a reduction in the concentration of the metallic ions of manganese, iron, copper, and zinc.

Reinhart, K. G., and H. W. Lull.

1969. **Forests and floods: A reconsideration.** (Abstr.) Soc. Amer. Foresters Proc. 69: 19-20.

A discussion of the influence of forests and forestry on floods in the eastern United States. Management should concentrate on reforestation of nonforest lands, improved forest roads, and protection from overburning and overgrazing.

Tanner, C. B., C. A. Federer, T. A. Black, and J. B. Swan.

1969. **Economical radiometer—theory, performance and construction.** Univ. Wis. Coll. Agr. and Life Sci. Res. Rep. 40, 86 pp., illus.

A complete manual on the construction and use of the economical radiometer, an instrument for measuring solar and longwave radiation fluxes near the earth's surface.

Whipkey, R. Z.

1969. **Storm runoff from forested catchment by subsurface routes.** In **Floods and their computation.** Int. Assoc. Sci. Hydrol. Leningrad Symp. Proc. 1967: 773-779, illus.

Subsurface stormflow is the major source of flood flows from wet unfrozen forest soils of the Allegheny-Cumberland Plateau. Studies showed that greatest quantities and rates of flow were from fine-textured soils and that turbulent storm flow occurred primarily from large openings in the soil profile. Preliminary plot treatments using contour trenching and backfilling have minimized subsurface storm flow from the catchment region above the trench.

FOREST RECREATION

LaPage, Wilbur F.

1969. **Campground marketing: the heavy-half strategy.** USDA Forest Serv. Res. Note NE-93, 6 pp. NE. Forest Exp. Sta., Upper Darby, Pa.

Half of the campers do much more than half of the camping. Campers in this heavy-half consistently camp more, year after year, and are increasing their annual participation as well. Heavy-half campers have larger investments in camping equipment, and their annual camping expenditures are nearly three times that of the light half.

LaPage, Wilbur F.

1969. **The camper views the interview.** J. Leisure Res. 1(2): 181-186.

A follow-up study after a campsite interview with New Hampshire state park campers revealed that these campers are receptive to being interviewed and do not consider interviews up to 1/2 hour burdensome. The study suggested that the interview situation is capable of influencing the quality of data collected. Differences between interviewers may bias the survey. These problems may be counteracted through question construction and interviewer training.

LaPage, Wilbur F.

1969. **The family camping phenomenon—motivation—ways and means—accommodations.** SE. Park and Recreation Training Inst. for Planning Maintenance and Operation Proc. 14: 14-19.

The prevalence of unrealistically low prices for camping and inadequate analysis of the demand for it show that little is known about the motivations that cause and sustain an interest in camping. If the camping phenomenon is to be sustained, there must be increased market research leading to better communication between campground owners and campers.

Moeller, George H.

1969. **The snowmobile: boondocks bonanza or bust?**
N. Logger 18(5): 24, 43, 45, illus.

A forest-land owner keeps his hired men busy and land in use during the winter by leasing snowmobiles and maintaining trails for them on his 500-acre reforested farm. Initial cost, management problems, consumer characteristics, and profitability and future plans of his snowmobile business are discussed.

Noyes, John H.

1969. **Management of birch for aesthetics and recreation.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 178-180. Upper Darby, Pa.

Some modifications in cultural practices are usually needed to assure perpetuation of birches in areas devoted to aesthetics or recreation. More frequent weedings, thinnings, and improvement cuttings; seedbed scarification; use of small burned patches; and direct-seeding or planting may be needed. Managers should take advantage of the ability of stump sprouts to develop multiple stems. Harvesting systems that involve large clearcut areas should be avoided.

Rutherford, William, Jr., and Elwood L. Shafer, Jr.

1969. **Selection cuts increased natural beauty in two Adirondack forest stands.** J. Forestry 67: 415-419, illus.

Color photos were used to determine the preferences of five groups of respondents regarding the relative attractiveness of undisturbed forest stands and 10- to 12-year-old selectively cut areas in Adirondack hardwood and softwood stands. The

respondents preferred cut to uncut stands in softwoods but found both equally attractive in hardwood stands.

Shafer, Elwood, Jr.

1969. **"Natural landscape preferences: a predictive model": a reply.** J. Leisure Res. 1(2): 197-198.

A reply to criticism of research methodology used.

Shafer, Elwood L., Jr.

1969. **The name of the game is recreation research.** (Abstr.) Rural Sociol. Supp. Sociol. Abstr. Supp. No. 4 (Part 2 of 4 parts), Abstr. No. D, 8886.

Outlines methods of attacking problems in recreation systems and describes three areas of recreation research and their related systems.

Shafer, Elwood L.

1969. **Recreation demand from wharf to waterfall.** (Abstr.) Soc. Amer. Foresters 1968 Annu. Meeting Abstr. Papers: 15.

An examination of recreation demand, emphasizing the need for understanding the forces that create demand for forest recreation activities.

Shafer, Elwood L.

1969. **Recreation demand from wharf to waterfall.** Parks & Recreation 4(8): 18-20, 56, 57, illus.

Recreation demand is examined briefly across an urban-suburban-rural spectrum. Renovations of present research efforts are needed if forest managers are to meet society's demands for forest recreation, bring people closer to nature, and yet avoid the pitfalls of polluting outdoor recreation environments.

Shafer, Elwood L., Jr.

1969. **The average camper who doesn't exist.** USDA Forest Serv. Res. Paper NE-142, 27 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.

A questionnaire survey of campers at five New York State campgrounds revealed that campers vary so much—not only from campground to campground, but also at the same campground from month to month—that data from such studies cannot be lumped together in any meaningful way. Causes of the variation are discussed. The author recommends that future camper surveys should be stratified by months and similar campgrounds.

Shafer, Elwood L., Jr.

1969. **Perception of natural environments.** Environ. and Behav. 1(1): 71-82, illus.

The measurement of perception of natural environments can

provide a basis for planning, developing, and managing those environments to meet the demands of outdoor recreationists. Some variations involved in the perception of natural environments are pointed out; several procedures used to measure perception are described; and some guidelines for future research are indicated.

Shafer, Elwood L., Jr., and James Mietz.

1969. **Aesthetic and emotional experiences rate high with northeast wilderness hikers.** *Environ. and Behav.* 1(2): 187-197, illus.

Results of this study indicate that an attitude scale can be used to quantify some qualitative values of wilderness recreation. Hikers were found to place primary emphasis on aesthetic and emotional experiences and comparatively little emphasis on educational or social ones as their reasons for seeking wilderness recreation.

(Shafer, Elwood L., Jr., and William Rutherford, Jr.)

1969. **Selection cuts increased natural beauty in two Adirondack forest stands.** *J. Forestry* 67: 415-419, illus.

Color photos were used to determine the preference of five groups of respondents regarding the relative attractiveness of undisturbed forest stands and 10- to 12-year-old selectively cut areas in Adirondack hardwood and softwood stands. The respondents preferred cut to uncut stands in softwoods but found both equally attractive in hardwood stands.

WILDLIFE HABITAT

Jordan, James S., and Francis M. Rushmore.

1969. **Animal damage to birch.** *USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.*: 155-163. Upper Darby, Pa.

White-tailed deer, yellow-bellied sapsuckers, porcupines, moose, and hares are responsible for most of the damage done to birches by wildlife. The authors review reports of damage, discuss underlying causes of damage, and describe possible methods of controlling damage by these animals.

Shafer, E. L.

1969. **Deer-food quantity measurements: what method is best?** *NE. Deer Study Group Trans.* 3: 115-120.

The best method for measuring deer-food quantity depends on

the biological situation and on the public attitude. The hunting public must be able to understand and accept the results, especially if the deer herd is to be reduced.

Shaw, Samuel P.

1969. **Management of birch for wildlife habitat.** USDA Forest Serv. NE. Forest Exp. Sta. Birch Symp. Proc.: 181-183. Upper Darby, Pa.

The list of wildlife species that prefer the birches for food is a long one. The key to planning an overall timber-management system to produce optimum wildlife habitat is to strive for a good distribution of forest stands representing different age groups over the entire home range of the wildlife species to be favored.

Thomas, Jack W., and James C. Pack.

1969. **Joe Typical: profile of a hunter.** Outdoor W. Va. 32: 19-20, illus.

Interviews with 1,353 hunters who had hunted in a mountainous 20,000-acre study area near Neola, W. Va., were used to depict the typical hunter. The principal characteristics considered were age, sex, residence, travel distance, game sought, weapons used, and hunting effort and success.

Worley, David P., and John D. Gill.

1969. **Strengthening the wildlife manager's hand in multiple-use conflicts.** NE. Fish and Wildlife Conf. 26: 11-25.

A method for identifying and resolving conflicts in forest use is proposed. The procedure uses production functions in graphic form to identify conflicts between competing uses and to help coordinate wildlife use with other uses. The method is applied to deer, squirrels, turkey, and timber.

FORESTRY ENGINEERING

Billar, Cleveland J.

1969. **Prediction of skidder tire wear in Appalachia.** Amer. Soc. Agr. Eng. 1969 Winter Meeting Proc: 19 pp.

Multiple regression was used to determine prediction equations for estimating tire wear on wheeled skidders, based on production levels. The equations can be used to determine more accurate production costs.

Gibson, Harry G., Robert L. Hartman, Donald L. Gochenour, Jr., and Homer W. Parker.

1969. **Wheeled skidder performance on sloping terrain.** Agr. Eng. 50(3): 152-154, illus.

Studies of winching with wheeled skidders in Appalachia showed that production drops off considerably as the terrain levels off and the distance from the skidder to the log increases, but that slope up or down hill had little effect on winching time. No relationship was found between slope or brush and winching force, but winching at an angle considerably reduced the maximum force attained during straight-on winching.

Gochenour, Donald L., Jr.

1969. **Analysis of computer results of loading tests.** W. Va. Univ. Eng. Exp. Sta. Rep. 9, 40 pp., illus. Morgantown, W. Va.

A multiple-regression analysis was used to analyze the log-loading operation and the variables that affect the loading cycle. The various loading operations are described, showing the variables involved, and a comparison of the results obtained under similar conditions is given.

Wysor, Paul S., and Curtis D. Goho.

1969. **How mountains influence highway trucking speeds and costs in Appalachia.** S. Lumberman 219(2728): 135-137, illus.

A study of trucking time in mountainous terrain showed that up-hill grades reduced truck speed about 20 m.p.h. and down-hill grades reduced speed about 10 m.p.h. Between mountains the average speed of a loaded truck was about 40 m.p.h. Includes ways to estimate additional costs for hauling logs on mountain highways.